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ABSTRACT

An increasing number of educators advocate the feeling dimension in learning. Quality emotions and feelings assist students in achieving optimally in the cognitive domain. Individuals who are hostile, negative, have short attention spans, and mistreat others in the classroom have more difficulty reaching their potential than other students in the same setting. This paper explores the need for affective objectives in science education. Several relatively new programs stress emotions and their consequences for individuals. Teaching teams of student teachers and cooperating teachers stress student involvement in science curriculum development. In several situations these teaching teams had worked out a set of learning centers whereby students individually could choose which tasks to pursue and which to omit in an ongoing science unit of study. Learners might then sequence their own experiences. Teachers served as guides and assisted as well as encouraged students to continually achieve. Democracy emphasizes that students respect each other's ideas and contributions and students achieve more optimally when democracy is practiced in the classroom. Suggestions include class discussion within committees and other cooperative learning opportunities. (PVD)

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Affective Objectives in the Science Curriculum

by Marlow Ediger

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AFFECTIVE OBJECTIVES IN THE SCIENCE CURRICULUM

Science teachers need to stress three kinds of objectives in teaching and learning. The first kind, cognitive, does receive major emphasis by teachers. Cognitive goals stress pupils achieving well in acquiring vital facts in ongoing lessons and units of study. There are selected educators in science who tend to downplay the importance of vital facts that learners are to achieve. Perhaps the problem here is more of what is done with the facts as compared to saying that pupils achieving factual information is evil. Facts are the building blocks of developing concepts. Concepts are broader than facts and may contain many facts in each concept. Consider the following fact: there are three major kinds of rock- igneous, metamorphic, and sedimentary. I believe this is a valuable fact for pupils to achieve in a unit on "Rocks and Minerals." The term "igneous" is a concept. Many facts are contained therein, such as

1. Igneous rock comes from the interior of the earth where temperature readings are very high.
2. Molten rock is made of magma and lava.
3. The molten rock comes through fissures in the earth.

In addition to vital facts and concepts, pupils should also acquire major generalizations. Generalizations in science relate several concepts into a declarative sentence. The following is a generalization:

Common forms of igneous rock are granite used for tombstones, pumice used in building materials, and obsidian used in making decorative items. The concepts here are igneous rock, granite, tombstones, pumice, building materials, obsidian, and decorative items.

In addition to facts, concepts, and generalizations, pupils also need to be able to think critically. When pupils, for example, make comparisons among igneous, metamorphic, and sedimentary rocks, critical thinking is involved. When pupils brainstorm the many uses of rock and think of unique uses also, then creative thought is in

evidence. Going one notch higher in cognitive objectives, if pupils engage in problem solving, they need to identify a problem, gather information in answer to the question or problem, and test the information in a utilitarian situation. The following are examples of identified problems:

1. Why does the interior of the earth continually become hotter the further one goes inside the surface?
2. What causes volcanic eruptions?

Cognitive objectives are salient for pupils to achieve in ongoing lessons and units of study. Thus there is much knowledge that a pupil needs to acquire as well as use the knowledge in a practical way in society. Related to cognitive objectives are affective ends for pupil attainment.

Affective Objectives in Science

Affective objectives involve attitudes, feelings, emotions, and beliefs. There are several relatively new programs in science education that stress the emotions and their consequences for individuals. I have noticed several of my student teachers and cooperating teachers, called a teaching team, whom I supervised in the public schools who stress much pupil involvement in the science curriculum. These teachers emphasize rather heavy pupil involvement in curriculum development. In several situations these teaching teams had worked out a set of learning centers whereby pupils individually could choose which tasks to pursue and which to omit in an ongoing science unit of study. Learners might then sequence their very own experiences in the ongoing science unit of study. I will describe one set of centers I observed in which the unit of study in science was entitled, "The Changing Surface of the Earth." The following learning centers were then in evidence:

1. a soil erosion center
2. folding and faults in and on the earth's surface
3. flood damage in an area center

4. contours, strip cropping, terracing, and planted grass/trees to avoid erosion

5. wind and water erosion

6. the weathering process, including freezing and thawing

7. pollution of the natural environment

8. saving forest regions

9. mining for rocks and minerals in a responsible manner

10. use of natural resources responsibly.

Each center had concrete (real objects and items), semiconcrete (audiovisual aids), and abstract materials of instruction (cassettes, reading materials, written work, discussions and other oral communication activities). There were four to five tasks per learning center for pupils to select to work on. For example, center #2 above had the following tasks on a task card:

1. By using reference material at this center, find causes for both folding and faulting.

2. Using the modeling materials, make a model of folding and of faulting in and on the planet earth.

3. Prepare an oral report on folding and faulting to be presented to the entire class.

4. Make drawings of folding and faulting for display on walls in the hallway.

5. What happens to lives and property when severe faults cause problems?

Pupils at these learning centers make many decisions, such as which tasks to pursue sequentially. Teachers are guides and encourage as well as assist pupils to achieve continually. The pupil then chooses which tasks to complete and which to omit. The choices are made based on purposes possessed by each pupil. Then too, there are ample opportunities for pupils to work collaboratively if they so desire. There are activity centered tasks as well as those that require or stress more of abstract endeavors. The learning style of individual pupils are involved in making decisions. The teacher does

not dictate nor lecture what pupils are to learn. The interests of pupils are salient in learner centered instruction. Thus the attitudinal dimension of the learner is paramount in an affective centered science curriculum. The feelings and emotions are involved here in decisions made. The pupil also assists in evaluating his/her own progress in products and processes of learning.

Emotional Intelligence

There are an increasing number of educators who advocate the feeling dimension in learning. Pool (1997) summarizes key ideas presented by Dan Goleman (1995) who wrote Emotional Intelligence and speaks frequently at educational conventions; these main ideas follow. According to Goleman, there are five dimensions of emotional intelligence. First is self awareness. Here, pupil realize increasingly so that there are personal strengths and weaknesses and use these to become decisive in decision making. Understanding their very own feelings is important so that action options are more prevalent. Self confidence is very important in order to make choices and act to make decisions.

Second, pupils need to learn to handle their emotions. Impulsive behavior may make for incorrect decisions. Learners need to develop more of a wait approach so that options may be scrutinized in terms of advantages and disadvantages. The consequences of each choice need to be assessed. Being impulsive might well lead to improper ends in life. Third, learners need to feel motivated in achieving definite goals. Hope is involved in having these goals in life. The motivation then comes from diverse goals that an individual aims for. Optimism is necessary to achieve and reach objectives one has in mind. Fourth, empathy is very important for pupils to develop. Feelings of empathy make possible to sympathize with others. Empathy is learned. Thus one learns to assist others in positive ways or be brutal to others. Compassion for others is important. Fifth, the development of social skills enables a pupil to help others in every day situations in life. Politeness and friendliness enable a person to

interact well with others in society on a daily basis.

Emotional intelligence harmonizes well with an affective science curriculum. Thus with pupil/teacher planning of the curriculum, self awareness is developed increasingly so when pupils select the order of learning activities in science. Strengths in decision making should be an end result. When pupils learn to handle emotions, there is persistence and effort put forth in learning. The immediate goal is not what is necessarily good such as in impulsive behavior. Rather the pupil needs to evaluate the pros and cons in making choices. Motivation is necessary in order that goals are achieved by pupils in science. With the absence of goals, energy levels for learning go downhill.

Feelings of empathy make it possible for pupils individually to get along well with others. In school and in society, it is necessary to have good human relations so that achievement and group efforts are possible. Human beings are feeling individuals, not automatons. Social skills need learning by pupils so that a friendly and considerate environment is available for all to achieve more optimally. Committee endeavors in ongoing lessons and units of study in science provide many opportunities for pupils to develop social skills.

Pertaining to humanism as a psychology of education, Woolfolk and Nicolich

(1990) wrote:

Humanistic interpretations of motivation emphasize personal freedom, choice, self-determination, and striving for personal growth, or as A. H. Maslow (1954) called it, self-actualization. With these emphases, the humanistic psychologists tend to be in harmony with many of the constructivist approaches. Perhaps most important is the fact that both views stress intrinsic motivation.

Shepherd and Ragan (1982) outline a summary of A. H. Maslow's (1954) hierarchy of human needs or goals as follows:

1. Physiological– a need to survive
   A. Homeostasis– a balance of internal bodily functions
   B. Appetites–need for nurture-food, sleep, air, elimination...
2. Safety–freedom form damage and threat

A. Routines and Rules (know and accept)
B. Consistency and security...

3. Belongingness—need for love and affection..
A. Intimate relations with other people
B. To be accepted, wanted, and cherished...

4. Esteem—status, recognition, competence, importance, independence
A. Personal-need for strength, mastery
B. Group—reputation, status, dominance, appreciation...

5. Self-Actualization
A. To satisfy potential—you must be what you can be...

In my own experiences as teacher, school administrator, and university professor, including supervising student teachers and cooperating teachers for thirty years, I believe affective and cognitive objectives interact. It is difficult to separate the two categories of goals. Thus when I speak at conventions for teacher education and write for publication, I stress that quality emotions and feelings assist pupils to achieve at a more optimal rate in the cognitive domain. My observations of pupils in the public schools indicate that individuals who are hostile, negative, have short attention spans, and mistreat others in the classroom have a difficult time to achieve what their potential is, much more so than other pupils in the class setting. Thus quality attitudes in the affective dimension assist learners to achieve more optimally in the cognitive area.

Humanists desire openended or general objectives, rather than measurably written or behaviorally stated objectives for pupils to achieve. Why? Not all pupils, by any means, learn the same things due to choices and decisions made by pupils in ongoing units of study (see learning centers above for examples). If teachers determine objectives for all pupils to achieve in science units of study, there is no room for learners to select and omit selected learning opportunities, based on learner perceived purposes. If pupils select sequential objectives to achieve, within a flexible framework, a psychological sequence is involved as compared to a logical order whereby the teacher arranges the order of objectives for pupil attainment.

Sequence resides within the learner, not within the minds of teachers or textbooks in science. Formal means of teaching here are eliminated and replaced with learner choices and decisions as to what to learn and what to omit. The feeling, affective dimension is definitely involved in making choices and decisions (Ediger, 1996).

A pupil centered curriculum might be emphasized, in part, through individualized reading in science. Thus instead of using basal textbooks in science units, pupils may choose to read library books that related directly to the unit title being studied. In a unit on "The Changing Surface of the Earth," an adequate number of library books on different reading levels need to be available for pupil choice. I have observed this approach to be very successful in ongoing lessons and units of study. Pupils then relate what was read from a library book read to the ensuing discussion. There appears to be much discussion and excitement when this approach is used in teaching science. Pupils might then notice different points of view expressed which can lead to analysis and evaluation of subject matter read.

In addition to pupils choosing sequential library books to read and relating the content to ongoing discussions, the science teacher might also have conferences with individual pupils or several pupils who have read the same library book where multiple copies of a book were available. Here, the teacher might observe pupil enthusiasm, interest, and quality of comprehension. The science teacher can always diagnose strengths and weaknesses shown by pupils in the conference setting. What has been diagnosed as weaknesses might then be remediated through additional learning activities (Ediger, 1997). Pupil choices in the science curriculum might be made in whole or in part. The latter might be stressed in individualized reading in science which then substitutes for the basal textbook in ongoing units of study.

Democracy in the Science Curriculum

Democracy as a way of life emphasizes that pupils respect each other's ideas and contributions. Ridiculing and minimizing others has no role to play in democratic situations. Pupils should achieve more optimally when democracy as a way of life is practiced.Fenstermacher (1996) wrote:

> We hear a great deal about readying the next generation of workers for global competition... about world class standards for what is learned in school. We hear almost nothing about building civic participation or building and maintaining democratic communities, whether these be neighborhoods or governments at the local, state, or federal levels. The advancement of democratic ideals and institutions goes largely unmentioned, taken for granted or insufficiently important to rank up there with such world shaking events as or playing Avis to Japan's Hertz.

Pupils discussing current events items in science provide excellent opportunities for learners to practice tenets of democratic living within a committee endeavor. In one of my classroom observations, student teachers and cooperating teachers orientated learners in the classroom to bring from the home setting current events items pertaining to natural disasters. These natural disasters included tornadoes, hail, volcanic eruptions, floods, strong winds, heavy snow, and ice storms, among others. News items could deal with different times of the year. The clippings were brought to class for discussion within a committee endeavor. A large world map was placed at the center of a bulletin board. Yarn was used to connect the happening from the news clipping with the place of occurrence, located on the world map.

I have observed numerous student teachers and cooperating teachers whom I have supervised stressing democracy in the classroom with cooperative learning endeavors. These teachers have developed standards with pupils in terms of how a committee should function. The following were developed as standards for a committee, with teacher guidance, to work by in discussing current events in science:

1. respect each other and the thinking of others
2. listen carefully to the thinking of committee members as ideas are being presented
3. have all pupils participate in discussing current events in science within the committee
4. let leadership emerge as the discussion moves forward
5. ask questions if comments made are not clear
6. do not interrupt when others are participating.

These criteria were posted in the classroom and reviewed with learners prior to each committee working in the area of discussing current events in science. After committee work, members with teacher guidance evaluated how well the group had followed each criteria. It appears that reviewing with pupils the meaning of each standard and appraising if individual standards are being met is helpful to learners. Pupils can be taught democratic tenets as a way of life. Pupil achievement hinges on being able to accept others more fully and not reveal animosity or ill will toward others. Positive attitudes toward others enhances the individual to achieve more optimally in the cognitive domain as well as make for better feelings about the self. Pupils seemingly quarrel less and assist each other more when healthy self concepts and emotional well being are in evidence.

Conclusion

The emotions, feelings, and values are important parts of an individual's well being and achievement in life. Science teachers should emphasize an adequate number of objectives stressing the affective domain. Actually, the affective domain cannot be separated from the cognitive. If pupils possess quality attitudes, the chances are the rest will be achieved well in life as much as the individual is capable.

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